

**U.S. EPA Environmental Technology Verification Program
Advanced Monitoring Systems Center**

Air Stakeholder Committee Meeting

**September 24, 2003
Crystal City, VA**

FINAL MEETING MINUTES

ATTENDEES

Stakeholder Committee Members:

Jeff Cook, California Air Resources Board
Chuck Dene, Electric Power Research Institute
Rudy Eden, South Coast Air Quality Management District
Philip Galvin, New York State Department of Environmental Conservation
Tim Hanley, EPA/OAQPS
Lindene Patton, Zurich North American
Donald Stedman, University of Denver

Observers:

Teresa Cendrowska, ASTM International
Bill Gillespie, Mid-Atlantic Regional Air Management Association
Jerry Hatfield, US Department of Agriculture-ARS, National Soil Tilth Laboratory
Bob Vanderpool, EPA/ORD
Abby Waits, EPA/ETV Program/ORD/NRML

EPA/Battelle AMS Center Staff:

Robert Fuerst, EPA/ORD/NERL
Gretchen Hund, Battelle/PNNL
Tom Kelly, Battelle
Karen Riggs, Battelle

Welcoming, Agenda, and Meeting Objectives

Karen Riggs, the Battelle Project Manager for the ETV Advanced Monitoring System (AMS) Center, welcomed the committee stakeholders and observers and outlined the following objectives for the meeting:

- Update on ETV Program Status
- Update and Input on AMS Center Current Verification Tests
- Partnering with USDA on Ambient Ammonia Monitoring

- ASTM and Standardization
- National Air Monitoring Update
- Coordination with EPA's Evaluation of Coarse PM
- Identify Future Technology Categories for Verification

Bob Fuerst, the EPA Project Manager for the AMS Center, also thanked the stakeholders for coming and stressed the importance of their feedback in steering the agenda for the Center.

Stakeholder Insights since the Last Meeting

Gretchen Hund asked the full group to report on what their network has to say about ETV and specifically whether ETV's visibility seems to be improving or not.

For the benefit of the observers, each stakeholder introduced him or her self and described his or her role within his or her organization and interest in air monitoring. One stakeholder representing a state reported that he reviewed the mercury report and was impressed by it. Another stakeholder said that he fears that ETV is still low on the radar of some states. He cited one state's publication that discussed the distribution of ambient air monitoring devices and made no reference to ETV and the testing it had done of these devices. One stakeholder raised the issue that a particular vendor claimed that he was not interested in going through ETV even though his competitors were. His claim was that he already had the majority of the market and that his competitors' devices were of such lesser quality that he was not threatened. Another stakeholder had spoken to a vendor that felt that Germany's TUV program was more rigorous than ETV and that it was more valuable to him because it was recognized worldwide. The mercury monitoring work was touted as getting a fair amount of visibility and having good vendor interest.

Phase II Verification Status of Mercury Continuous Emission Monitors

Tom Kelly from Battelle reported on the outcome of this test, and noted the numerous organizations involved in this testing. The testing site was US DOE's TSCA incinerator at Oak Ridge's East Tennessee Technology Park. The incinerator was operated normally and continuously throughout the verification test period. A large quantity of aqueous waste was segregated before the test, solid wastes of low and high mercury content were also used, but there was no spiking of mercury. Five continuous emission monitors (CEMs) were verified during the test: a Nippon unit (MS-1/DM-5) that continuously monitors elemental and oxidized mercury, and another Nippon unit (DM-6D) that measures total mercury; a PS Analytical Sir Galahad II unit that in batch format monitors for total mercury with 5 minute readings; an Opsis unit (AM Hg-200) that operates in batch format with readings every 5 minutes measuring total mercury; and an EnviroMetrics Argus-Hg 1000 unit that provides a reading of total mercury every 7 minutes. These units were operated and maintained by facility staff for 5 weeks between two separate Ontario Hydro (OH) reference sampling periods. Testing was conducted from August 15 to September 20, 2002. The results from most CEMs correlated well with the OH runs, but absolute agreement with OH results was generally not within 20%. Sharp spikes in mercury

concentration occurred with burnings of solid wastes, and were difficult for the batch analyzers to follow. A couple of CEMs had some problems during the test that reduced their data completeness substantially. The verification reports were signed by EPA in September 2003 and Battelle has re-opened discussions with EPA-OAQPS about Phase III testing at a power plant.

Verification Status of On-Board Vehicle Emission Monitors

Clean Air Technology, Inc. was the vendor whose on-board monitor was tested (May 2001). This unit, called the REMOTE OEM, determines CO, CO₂, and hydrocarbons by infrared and NO, NO₂, and O₂ by an electrochemical sensor. The OEM is a portable device that samples exhaust and connects to the data port on the engine of a vehicle. Reporting was held up for quite some time because full payment of the verification fee was not received. Battelle decided to move ahead and finish the reporting. The results in comparing the unit to a dynamometer were quite good. The unit was never down during testing, there were no problems with installing it in vehicles, and it was unaffected by temperatures up to 100° F. It was even found that on-road readings from dual units were nearly identical. EPA approved the verification report in September 2003. One stakeholder raised the issue of possibly having NYSERDA fund a test of the diesel version of this device.

Verification Status of Ambient Ammonia Monitors

Karen Riggs gave this presentation, and indicated that ammonia emissions at animal feed operations (AFO) is 70% of the total atmospheric ammonia emissions in the United States. Battelle tested ammonia monitors at two AFO facilities (a swine feed operation in Ames, Iowa and a cattle feed yard in Carroll, Iowa). These tests were conducted over a four-week period in the Fall of 2003. Reference testing was conducted during weeks two and three based on EPA Method IO-4.2. Seven vendors participated in the testing using different types of technologies. The following list summarizes them:

- Aerodyne Research, Inc. – tunable diode laser spectroscopy
- Bruker Daltonics (Phase 2 only) – open-path IR spectroscopy
- Molecular Analytics – ion mobility spectrometry
- Omnisens SA (Phase 2 only) – IR laser spectroscopy with photoacoustic detection
- R&R Mechatronics – selective membrane diffusion with conductivity detection
- Thermo Electron Corp. – conversion to NO with chemiluminescence detection

Battelle hosted a technology field day for this verification on September 4, 2003 that was attended by around 50 people including EPA and USDA dignitaries. The preliminary observations of the testing were that the units were fairly easy for a trained technician to use. Two of the units required user intervention after suspected power loss, while the others did restart or did not lose power. Maintenance ranged among none, weekly, and twice daily across the units. Under accuracy, the units were found to have reasonable responses to ammonia gas standards. Performance ranged from seconds to 5 minutes for data acquisition and response time ranged from seconds to 15 minutes. Cost ranged from \$20K to \$150K. Stakeholders Roy Owen and Ernie Bouffard were involved in reviewing the test plan for this verification. Stakeholders

suggested that the report describe the ammonia concentration range over which the testing occurred to understand specifically how the instruments responded. Ammonia emissions around a lagoon would be much different than away from such a high source. Also knowing how ammonia in nitrate and sulfate particles contribute to emissions would be important. The term ambient monitoring usually implies very low concentrations of a contaminant and stakeholders wanted to know the detection limit of these devices to determine if the units would be useful in other settings.

USDA's Perspective as Partner in the Ambient Ammonia Test and Their Monitoring Needs

Jerry Hatfield from USDA gave this presentation from USDA. Jerry is the Director of the National Soil Tilth Laboratory in Ames Iowa. Jerry first described the air quality associated with agricultural operations and listed the main gas emissions as being ammonia, methane, nitrous oxide, hydrogen sulfide, and 300 different VOCs. Particulate matter emissions can also affect air quality. He described the complexities of agricultural systems in their shape, size, density of animals, position of the operation on the landscape, and meteorological conditions and fluctuations that are daily and seasonal. These AFOs are required to define their emission rates to determine the effectiveness of treatment or management techniques. Typically they use nitrogen mass balance, flux chambers, and micrometeorological methods to estimate emission. Deep pits, earthen storage (anaerobic digestions), and lagoons are used to handle manure to reduce the land needed to handle waste. Farmers try to preserve nutrients in the manure instead of letting them into the air. In addition to ammonia, hydrogen sulfide is a large issue at sites and can be so concentrated that it kills animals. Jerry reported that the major air monitoring issues confronting AFOs are quantifying the emission rates through combined concentration and flux methods, comparing emission rates across a range of facilities, and developing an understanding of why and how the emission rates vary within and among production units. These challenges are why good measurement methods are critical such as the ammonia emission methods tested under ETV. To estimate the total emission from a facility, a good methodology is needed that links flux through a given area and concentration.

The Department of Natural Resources picks a point on the property to set up a monitor for emissions. Jerry acknowledged that point sampling is much easier than open path monitoring. USDA is trying to provide a type of air quality primer for the DNR regulators so that they can better make monitor placement decisions. Stakeholders felt that it might be worthwhile to have a link on the ETV website to USDA's primer.

Verification Status: Ammonia Continuous Emission Monitors (CEMs) – Slip Application

Tom Kelly gave this presentation on the ammonia CEM testing that was conducted over five weeks at a full-scale coal-fired power plant using a selective catalytic reduction (SCR) NO_x control technology. In this case the reference method was EPA's Conditional Test Method 027. The monitors were challenged with ammonia gas standards and zero gas. Two vendors participated in the test – Opsi and Siemens. Partners were the Electric Power Research Institute (EPRI) and EPA-OAQPS. EPRI was interested in how two different reference methods (EPA's

ion chromatography and ASTM's ion selective electrode) compare in analysis of ammonium solutions, and OAQPS is developing a performance specification to which the test results would provide input. The plant where the testing occurred was American Electric Power's Mountaineer plant in New Haven, West Virginia. The CEMs were installed at the exit of the SCR, upstream of the air heater. There is interest in these technologies because ammonia can form particles that plug the air heater and thus the power plants want to know when ammonia is slipping through. Ammonia spiking was conducted during the testing to see how well the CEMs could detect it. As of the time of the stakeholder meeting, the quantitative comparison of the two reference methods was not yet complete but it appears that qualitatively, the results appear similar. The reports are to be complete by the end of the calendar year.

ASTM's Role in Protocol Standardization and Possible Collaboration with ETV

Teresa Cendrowska from ASTM gave this presentation. She provided an overview of ASTM's role in the standardization process and a summary of its services and benefits. She stressed that standards development is a collaborative process that involves representatives from public and private sectors. It is market driven and maintains a sectoral focus when addressing the needs of each industry segment.

ASTM International is an independent, private sector, not-for-profit organization that provides a management system for developing voluntary, consensus standards. ASTM serves around 90 sectors including air under the environment sector. ASTM has 30,000 members with 100 countries being represented. The standards are developed voluntarily and used voluntarily but can become mandatory when cited in a contractual agreement or referenced by a government body. Much of the standard development is conducted electronically to facilitate member involvement and reduce travel costs. 11,000+ standards are published annually. The US National Technology Transfer Act (passed in 1996) urges federal agencies to adopt private sector standards where applicable. The American National Standards Institute (ANSI) is the accreditation entity for organizations developing standards. ASTM is one such organization.

One of the principles of ASTM standards is that it does not certify or accredit an organization for meeting a standard. Other principles include neutrality, openness and balance, consensus, credibility, relevance (each standard must be reviewed every five years; revisions may occur more frequently if needed; if a standard is not reviewed in this time frame then notice is given to remove it in 7 years).

There are several types of ASTM standards including:

- Test methods
- Specifications
- Guides
- Practices
- Terminology
- Classification

It was felt that an ETV testing protocol would best fit the test method category. Teresa offered some examples where an organization or agency offered their protocols as the basis of draft documents. She found that the format for ETV-AMS's protocol aligned very closely with the generic verification protocol used by ASTM. If ETV-AMS decided that it wanted to have one of its protocols adopted by ASTM, the next step would be to conduct due diligence to avoid duplication and invite the fullest participation. A preliminary meeting would be conducted to help determine consensus for this new activity. It might well fit under an existing committee (e.g., ASTM's Committee D22 – sampling and specifications).

When asked if there was any enforcement of ASTM's standards, Teresa reported that ASTM did not play that role and it would be up to contractual language between the buyer and consumer. Self-policing is the norm. It generally takes 6 months to 2 years to have a standard developed and approved.

Stakeholders discussed the possibility of pursuing this option and there was some concern that ASTM might be too slow to be helpful to the community that could benefit from such a standard. It was also raised that the ETV developed test methods are readily available through ETV, and free, and this would not be the case with ASTM (a standard is generally \$25 for a typical standard and \$70-80 for a large standard). Someone suggested checking with the ETV Air Pollution Control Committee to see whether they had considered this and what their perspective was.

National Monitoring Update for Air: What's Coming

Tim Hanley from EPA-OAQPS gave this presentation. He first reported on activities within the Emission and Measurement Center (EMC). They are reorganizing by combining their source methods activities and their source analysis activities and focusing on emission factors. Mercury CEMs are of central focus to this Center. They are working toward developing performance specifications and linking them with testing of sources. Tim acknowledged that ETV's role in mercury monitoring is critical to their work and the direction they are heading. The National Institute of Standards and Testing (NIST) is initiating a new, certified mercury gas standard (just focused on elemental mercury) that should be complete in one-two years.

Tim mentioned that staff rotate between the EMC (with a permitting focus) and the ambient group (his group with an exposure focus) to work on fence-line monitoring where the two worlds intersect.

In the ambient group, the main focus is on particulate matter (PM), ozone, precursors to ozone, and air toxics. The PM 2.5 network has been operating since 1999 and there needs to be 3 years of certified data which means that designation for PM is coming up next year. There are 1100 monitoring sites. The states have the latitude to move monitors around and re-prioritize them. Changes in the network will dovetail with the National Monitoring Strategy.

For ozone, there is an 8-hour designation that is on the horizon. The ORD quality assurance staff are working on how to implement the system.

In the air toxics area, community-based monitoring assessments are being done. Lots of compounds are part of these assessments.

As part of the Air Quality Index, there are 290 sites measuring PM 2.5 and numbers will start to be published nationally in October 2003 and will appear in newspapers like *USA Today*.

For PM Coarse, regulations were promulgated in 1997 but ruled to be unfair because of 0-2.5 micron particles counting twice. Of interest is to understand the health effects associated with Coarse PM. An EPA document will be forthcoming that describes the literature but does not make policy judgments. Policy will come later.

PM speciation is of real interest to many. There is a five-city speciation study on-going. Vendors keep updating their instruments and they don't line up with the reference method. Vendors are frustrated and states don't want to buy them unless they match the reference method. Tim has had vendors come to him that were not in the Round 1 ambient air monitoring testing that are interested in being ETV tested.

Tim provided an update of EPA's monitoring strategy. Funding is going towards trace gases that are good indicators of things (e.g., CO instead of just priority pollutants). They are heading towards a multiple-pollutant monitoring program and are struggling with how best to disseminate the data, not just collect it.

Verification Update: Ambient PM Monitors – Round 2

Stakeholders identified ambient PM monitors as a high priority to re-verify at the previous stakeholder meeting in January 2003. Karen Riggs explained that Battelle staff contacted vendors to determine their interest in participating in this test. Initially, vendors appeared interested, including those of light scattering devices (nephelometers) and beta attenuation monitors. Battelle pursued identifying test sites and partners for the test but to date, only two vendors have signed up so the test has been postponed. Initially those companies who expressed an interest included:

- Thermo (several tech's)
- MetOne
- BGI
- EcoTech
- TSI
- Tisch

The only two vendors who have signed up are Thermo and Tisch. Other vendors contacted, but who showed no interest were:

- R&P
- Environmental Devices
- Grimm
- Optec

- Radiance Research

Four candidate test sites (East St. Louis, Pittsburgh (NETL), Atlanta, and Bakersfield) all offered data sharing (Federal Reference Method PM2.5 on-going measurements, some including speciation), some infrastructure support (i.e., provide space, electricity, etc.), and low cost labor (\$15/hr).

Karen Riggs explained that Battelle is in a difficult position due to the lack of vendor interest in the test. Given how expensive it is to test this category of technologies, Battelle needs to have more than two vendors signed on to participate in the test. Furthermore, partner interest is good but not overwhelming. With stronger partner support, the fee required by vendors could be reduced which would likely increase their interest in participating. Battelle feels that a good path forward is to pursue greater contributions from partners in around six months and see if there is greater interest. Furthermore, there may be some technologies (e.g., speciation monitors, continuous carbon analyzer) that mature enough to be tested. Stakeholders encouraged Battelle to go back to vendors who participated in the 2001 test in about 6-12 months and ask them informally what they think should be done differently in the Round 2 test that might increase vendor interest.

Knowing that a later discussion was to cover future technology categories that should be considered, Karen continued the discussion of specific ambient monitors to determine which categories were of greatest interest to stakeholders. BTEX analyzers were first discussed. These are field rack mountable, real-time benzene analyzers that can measure half a dozen compounds. The EPA Air Toxics Program gives users the option of using them in the field in real time to measure the most risky compounds. Stakeholders knew of one vendor in Europe that owns most if not all of the air monitoring units in France. They take hourly averages of benzene and toluene. There is also Baseline Industries in Longmont, CO and Teledyne, Inc. Stakeholders thought this category was of medium importance to verify.

Another ambient monitoring category is PM continuous speciation monitors, which the committee found to be of high importance.

A third category is formaldehyde monitors that are real time. Tim Hanley said that he could give the Battelle team a name of one or two vendors. He felt, however, that they were of low to medium importance. Stakeholder Phil Galvin, however, felt that they were of high importance. Aero Laser was a vendor name suggested.

The point was raised that EPA plans to fund research on Coarse PM and that this may replace PM 10. The agency will need to make a decision on a reference method for Coarse PM which could drive the market. Stakeholders raised the possibility of ETV designing a test to independently test the reference method against vendor technologies. This testing could help demonstrate equivalency, give visibility to ETV, and help vendors.

EPA's Evaluation of Coarse PM

Bob Vanderpool from EPA-ORD gave this presentation. He described the work his group is conducting to evaluate coarse PM methods. They are studying samplers that provide mass concentration measurement and are commercially available. They are looking at both filter-based methods and semi-continuous methods. Specifically, they looked at:

1. Difference method (Coarse PM= PM10-PM2.5)
2. R&P Partisol – Plus 2025 Dichot
3. R&P Coarse Particle TEOM
4. Tisch SPM – 613D Dichot Beta Gauge
5. TSI Model 3321 Aerodynamic Particle Sizer

They are using a wide variety of sites to evaluate the relative mass concentration bias (RTP, NC, Gary, IN, Phoenix, AZ, and Riverside, CA). The RTP test was for their shakedown and all of the other cities had a 30-day test. They are using 27 samplers and so far have found that there is strong agreement (that is inter-manufacturer precision for filter-based devices is similar). The size of the particles does vary from site to site. They are using lab tests with samplers to understand the aerosol fractionation and / or particle loss issues to determine if the content of the aerosol is dictating the mass. Stakeholders were interested in EPA's effort in this area.

Discussion of Status and Future Technology Categories

Tom Kelly led this discussion about other technology categories that Battelle should consider based on feedback from stakeholders. He reminded stakeholders that the information Battelle needs to proceed with a new technology category is the names of vendors with commercial technologies that fit within the category, names of potential partners that can cost share the testing, and stakeholder volunteers to support the test.

The list of technology categories (in addition to the ambient monitors earlier discussed) that have been suggested previously include:

- Multigas emission analyzers – Round 2
- Mercury CEMs – Phase 3
- Ammonia CEMs (gas turbines)
- Stack organic speciation analyzers + continuous formaldehyde monitors for sources
- Handheld VOC monitors used for air quality analysis (e.g., sick building syndrome and possibly outdoors)
- Leak detection monitors (fugitive emission monitors)
- E-noses

Tom led the group through a discussion of each of these. He reminded them that efforts are in progress to establish the multigas emission analyzer Round 2. Battelle has already sent agreements to five vendors:

- IMR Environmental Equipment
- MKS Instruments

- Land Instruments International
- ECOM America
- TSI

Battelle has established a schedule with CE-CERT test facility to concurrently test up to three technologies. But none of the vendors appear willing to commit to testing at this time. TSI (and possibility ECOM) are interested in testing within the next 6 months so Battelle thinks this is a category that they should revisit in that timeframe.

Tom then discussed the Phase 3 mercury CEM test at a coal-fired utility. Tom mentioned that EPA OAQPS is looking for collaboration as part of the testing. They have been doing a worst-case challenge testing at a facility burning bituminous coal with only an electrostatic precipitator, but they found that the mercury levels were much less than what they expected. Currently, OAQPS has limited funding. Stakeholder Chuck Dene from EPRI reported that DOE has 16 projects where they are looking at mercury control and one or more may be a good site for ETV collaboration. Tom said that Battelle is assembling vendor information (over a dozen vendors) and that there does appear to be interest among those vendors who have been contacted thus far. Tom felt that the preferable timeframe for conducting this test was the spring of 2004.

The next category Tom discussed was Phase 2 of ammonia CEM testing (at a gas turbine facility). Battelle is at the stage of recruiting a partner for the test. Based on contacts from stakeholder Andy McFarlan, Battelle is looking into Texas power companies. Battelle is also talking with a contact at Siemens and with NESCAUM (who provides state regulatory contacts in New England). On the vendor front, Battelle is assembling information on about 20 vendors and those who have been contacted appear interested. Stakeholder Phil Galvin said that he knows there is a lot of interest in his state (New York) in this testing. The timeframe for this test is late winter 2004.

Tom mentioned that Battelle has not made much progress with the remaining technologies on the previous list (stack organic speciation analyzers + continuous formaldehyde monitors for sources, handheld VOC monitors used for air quality analysis (e.g., sick building syndrome), leak detection monitors (fugitive emissions), and E-noses.) Stakeholders felt that Battelle should back-burner E-noses for now as they applied to ambient air monitoring.

Stakeholders were asked to suggest other technology categories for Battelle to consider that were not on its list. Stakeholder Lindene Patton suggested monitoring for TCE vapor in buildings. She saw the need, particularly for sites contaminated with TCE given how it migrates through building foundations and into the building. She thought there was a market for such monitors.

Closing

There was no time to present the EPA-ETV Program update so this discussion was postponed. It was felt that Gretchen Hund from Battelle could forward the update to stakeholders and observers. Gretchen thanked all of the participants for attending the meeting and contributing so much to the program. The committee discussed the possibility of re-convening for a day during

the third week in June in Indianapolis, IN to dovetail with the Air and Waste Management Association (AWMA) conference. Gretchen promised to email stakeholders and determine if there was a sufficient number of them planning on attending the AWMA conference to warrant dovetailing the two meetings. The meeting adjourned at 5 pm.